Effectiveness of pitfall/drift-fence systems for sampling small ground-dwelling lizards and frogs in southeastern Australian forests

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ABSTRACT

The effectiveness of various pitfall trap designs and pitfall/drift fence systems for sampling small ground-dwelling lizards and frogs in the forests of southeastern Australia was examined. Pitfall/drift fence systems employing long drift fences were more effective than short or no-fence systems in terms of the number of individuals and species caught, but were time consuming and caused considerable habitat disturbance. Various pitfall trap designs were compared. Generally, simple open-necked and funnel traps were more effective than traps with shelter and shelter/drift arm traps. It is suggested that in forested habitats, groups of individual *open necked pitfall traps or short-fence systems* may be just as effective and no more costly in installation time than systems employing long drift fences and more complex trap types.

Key words: Survey techniques, Pit-falls, Lizards, Frogs.

INTRODUCTION

Few studies have compared the relative effectiveness of different pitfall and pitfall/drift fence systems for catching vertebrates in Australian ecosystems, despite their widespread use in survey and ecological research (Pengilley 1972; Cockburn *et al.* 1979; Davidge 1979; Mather 1979; Hopper 1981; Webb 1981, 1983, 1985; Menkhorst 1982; Bennett *et al.* 1989). As several recent authors, e.g., Braithwaite (1983), Friend (1984) and Morton *et al.* (1988) have suggested, the choice of pitfall/drift fence design and configuration has been largely a matter of logistics and personal preference, pointing to a need for quantitative comparison of techniques in different ecosystems.

Comparisons have been made between different pitfall/drift fence systems for sampling populations of small ground vertebrates (small mammals, reptiles and amphibians) in tropical, arid and semi-arid Australian habitats (Cockburn *et al.* 1979; Mather 1979; Longmore and Lee 1981; Braithwaite 1983; Friend 1984; Morton *et al.* 1988; Friend *et al.* 1989). While pitfall/drift fence trapping has proven to be a successful method for these relatively open habitats, the use of drift fences in the heavily forested areas of eastern Australia may be logistically impractical due to rough terrain and the often heavily littered forest floor.

Between 1979 and 1981 four trials were conducted in eucalypt forest in southeastern Australia to assess the relative effectiveness of various pitfall trap designs and drift fence configurations for sampling reptiles and amphibians in heavily forested habitats. Relative installation times for the drift fence configurations were also assessed.

METHODS

Comparative studies were carried out at several locations in Bondi State Forest (37°09'S, 149°09'E) near Bombala (New South Wales) (hereafter referred to as Bondi) and at Glenorie (formerly Maroota State Forest) (33°33'S, 150°59'E) near Sydney (New South Wales) (hereafter referred to as Maroota). Vegetation at Bondi is tall open and open eucalypt forest (*sensu* Specht *et al.* 1974), comprising mainly *Eucalyptus obliqua* L'Herit., *Eucalyptus viminalis* Labill. and *Eucalyptus radiata* Sieber ex DC., and savannah woodland comprising mainly *Eucalyptus pauciflora* Sieber ex Spreng., *Eucalyptus stellulata* Sieber ex DC. and *Eucalyptus dalrympleana* Maiden. At Maroota, the vegetation is "sandstone complex" dry open eucalypt forest (*sensu* Specht *et al.* 1974) comprising *Angophora costata* (Gaertn.) J. Britt., *Eucalyptus eximia* Schauer, *Eucalyptus gummifera* (Gaertn.) Hochr., *Eucalyptus piperita* Sm. and *Eucalyptus punctata* DC.

Pitfall trap design

All trap designs are illustrated in Figure 1. Five basic designs (OPEN, FUNNEL, SHELTER, DRIFT ARM and SHELTER/DRIFT ARM) and two trap sizes (5 and 10 Litres) were used in the four trials. Funnels were fitted snugly into the opening of the bucket and the narrow neck of the funnel was removed to leave an opening of approximately 90 mm. Shelters consisted of 50 cm × 50 cm

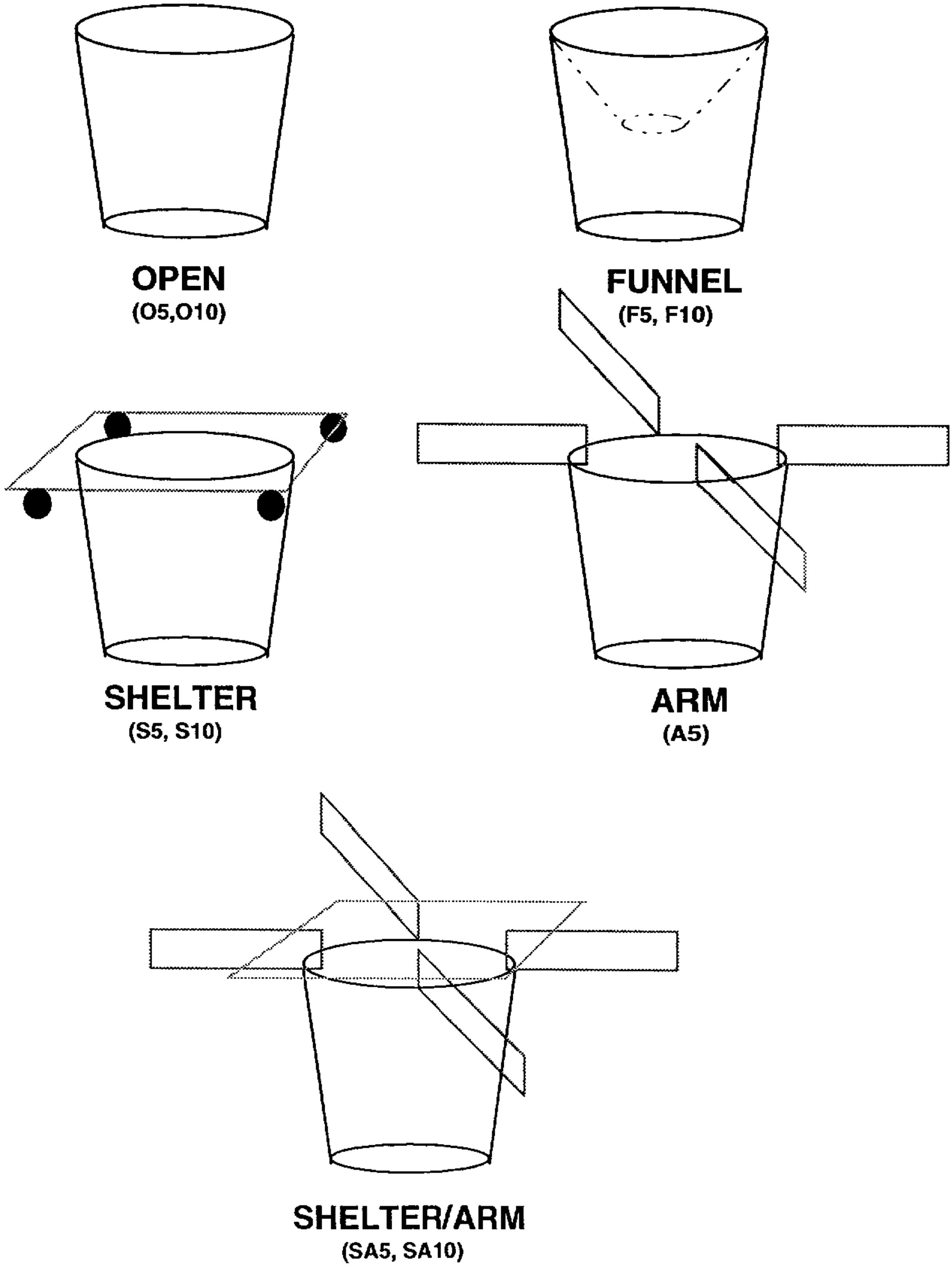

Figure 1. Pitfall trap designs used during this study. Trap codes used in Tables 1–4 are shown in brackets.

masonite sheets supported approximately 5 cm above the trap by large pebbles. Drift arms were small lengths of 3 mm thick plastic sheeting, 20 cm long and 5 cm high. Four were placed at 90° to each other, supported by small metal pegs with one edge slightly overlapping the lip of the bucket. Where shelters were used in conjunction with drift arms, the shelter was supported by the four drift arms.

Trial 1: Bondi (3 January–23 March, 1979). Three pitfall-drift fence systems were compared. Four replicates of each of the three systems and four vacant plots used for observation only, were assigned one to each of the sixteen 50 m × 50 m grid cells in a 4 ha grid. The following pitfall/drift fence trapping systems were used:

(a) one 40 m drift fence centred in the middle of the plot, aligned diagonally across the plot with one pitfall trap beneath each end,

(b) one 4 m drift fence centred in the middle of the plot, and aligned diagonally across the plot with one pitfall trap beneath each end,

(c) two single pitfall traps spaced 17.5 m apart and aligned diagonally across the plot.

Drift fences were 50 cm high blue polyfabric and secured vertically to the ground with metal pegs. A shallow trench was dug to accommodate the bottom of the drift fence and soil and litter replaced along each side of the drift fence. Pitfall traps were funnel trap type F10 (Fig. 1). Pitfall traps were checked daily during the period 3 January to 29 January, 1979 and the animals released off-site. For the remainder of the study, traps were filled with a formalin solution and the contents emptied at one week intervals.

Trial 2: Bondi (30 January–23 March, 1979). Two pitfall-drift fence systems were compared:

1. 4 m drift fence with a funnel pitfall trap (F10) (Fig. 1) at either end.
2. 4 m drift fence with a shelter pitfall trap (S10) (Fig. 1) at either end.

Two replicates of each were assigned one to each of four 50 m × 50 m plots in a 1 ha grid.

Drift fences were of identical design to the 4 m drift fences in Trial 1. Pitfall traps contained formalin preservative and were emptied and refilled weekly during the period of the study.

Trial 3: Maroota (29 September–23 November, 1979). Four pitfall trap designs (F, S, SA and O) (Fig. 1) and two trap sizes (10 L and 5 L plastic buckets) were compared. No drift-fences were used in this trial. Six replicates of each of the eight trap types were randomly allocated one to each of the 48 10 m × 10 m grid cells in a 0.48 ha grid. Traps were sunk flush with the ground and soil and litter replaced around the rims of the traps. Traps were part-filled with formalin preservative and emptied weekly.

Table 1. Frogs and lizards captured with three pitfall/drift fence trapping systems in Bondi State Forest. 0 m, 4 m and 40 m represent fence lengths. Only significant differences are indicated. Values in the same row with the same letter are not significantly different ($P > 0.05$). F-values and probabilities are provided where $P < 0.1$. Values for FROGSPEC, LIZSPEC and ALLSPEC are mean number of species with total number of species for that treatment in brackets.

	Pitfall/drift-fence system			
	0 m	4 m	40 m	
Frogs				
Limnodynastes peronii	0	0	1	
Pseudophryne bibronii	1^a	1^a	8^b	$F = 21.0$, $p < 0.01$
Ranidella signifera	0	0	1	
FROGTOT	1^a	1^a	10^b	$F = 16.2$, $p < 0.01$
FROGSPEC	0.25^a (1)	0.25^a (1)	1.00^b (3)	$F = 4.5$, $p < 0.05$
Lizards				
Eulamprus heatwolei	5	4	7	
Lampropholis guichenoti	0	1	0	
Saprosincus mustelina	0	0	1	
Nannoscincus maccoyi	3^a	9^a	24^b	$F = 5.79$, $p < 0.05$
Niveoscincus coventryi	11	4	16	
Pseudemoia entrecasteauxii	0	0	2	
LIZTOT	19^a	18^a	50^b	$F = 5.78$, $p < 0.05$
LIZSPEC	2.25 (3)	2.75 (4)	3.50 (5)	
ALLTOT	20^a	19^a	58^b	$F = 8.74$, $p < 0.01$
ALLSPEC	2.5 (4)	3.0 (5)	4.5 (8)	$F = 3.90$, $p = 0.06$

Table 2. Frogs and reptiles captured by different pitfall trap designs in Bondi State Forest. Values in the same row with the same letter are not significantly different (P < 0.05). F-values and probabilities are provided where P < 0.1. Values for FROGSPEC, LIZSPEC and ALLSPEC are mean number of species with total number of species for that treatment in brackets.

	Trap type		
	F10	S10	
Frogs			
Geocrinia victoriana	1	0	
Limnodynastes dumerilii	2	0	
Limnodynastes peronii	7[a]	0[b]	F = 49.0, p < 0.05
Pseudophryne bibronii	18[a]	1[b]	F = 289.0, p < 0.01
Ranidella signifera	3	0	
Litoria verreauxii	3	0	
FROGTOT	34[a]	1[b]	F = 1089.0, p < 0.001
FROGSPEC	4.5[a] (6)	0.5[b] (1)	F = 32.0, p < 0.05
Lizards			
Nannoscincus maccoyi	2	0	
Niveoscincus coventryi	14	5	
LIZTOT	16	5	F = 9.31, p = 0.09
LIZSPEC	2	1	
ALLTOT	40[a]	6[b]	F = 96.8, p < 0.01
ALLSPEC	6.0 (8)	1.5 (2)	F = 16.20, p = 0.06

Trial 4: Bondi (5 January–30 March, 1981). Four pitfall trap designs were compared. Five replicates of each of the four trap designs were randomly allocated one to each of twenty 5 m × 5 m grid cells in a 500 m^2 grid. Pitfall traps were all 5 L traps containing formalin preservative and sunk flush with the ground. Four trap designs were included (A, F, SA, S) (Fig. 1). Traps were checked and emptied weekly during this period.

One or two-way analysis of variance (PROC ANOVA — SAS 1987) was used to compare different pitfall-drift fence systems and pitfall trap types in the four trials. Analyses were also carried out on raw counts, and on rank, logarithmic (log + 1) and square root (SQRT + 0.5) transformed data. Plots of raw and transformed count data and residual data were examined using the Wilks-Shapiro statistic and equality of variance was checked using both Bartletts test and Cochrans Q test (Statistix v. 4.1, Analytical Software 1994). The Log + 1 transformation provided the best dataset for analyses. A mean separation procedure (Duncans multiple range test — SAS 1987) was used to compare means for trials with more than two treatments. The null hypothesis in each trial was that each pitfall-drift fence system or pitfall trap type would capture equal numbers of animals and species.

Taxonomic treatment of lizards follows Cogger (1992). The *Pseudophryne* sp. present in those trials in Bondi State Forest showed only a limited degree of colour development in the groin and arm-pits. I have therefore chosen to assign the name *P. bibronii* rather than *P. dendyi* to these animals.

The following acronyms are used in the text, tables and figures: ALLTOT (total individuals for all species combined), ALLSPEC (total number of species), LIZTOT (total number of individual lizards), LIZSPEC (total number of lizard species), FROGTOT (total number of individual frogs), FROGSPEC (total number of frog species).

RESULTS

Trial 1: Drift fence length

Significantly more *Pseudophryne bibronii*, FROGTOT, *Nannoscincus maccoyi*, LIZTOT and ALLTOT were captured in pitfall/drift fence systems using long (40 m) rather than short (4 m) or no (0 m) drift fences (Table 1). For *Niveoscincus coventryi*, fewer individuals were caught in 4 m drift-fence systems than in 40 m or 0 m systems but this difference was not expressed as a significant difference. The mean score for FROGSPEC was significantly higher for the 40 m system than the 4 m or 0 m systems. This trend of increasing mean scores with fence length was also apparent for ALLSPEC and LIZSPEC but not significant at the 0.05 level. For ALLSPEC, the difference between fence lengths approached significance (p = 0.06).

Trial 2: Shelter vs funnel traps (with 4 m drift fence)

Significantly fewer *L. peronii*, *P. bibronii*, FROGTOT, FROGSPEC and ALLTOT were

Table 3. Frogs and reptiles captured in different pitfall trap types in Maroota State Forest. Trap types are designated as an alphanumeric combination of a acronym for trap type and a number (5 or 10) for trap volume (in litres). O = open, F = funnel, S = shelter, SA = shelter/arm (see Figure 1 for details of trap designs). Values for FROGSPEC, LIZSPEC and ALLSPEC are mean number of species with total number of species for that treatment in brackets. Where trap design, trap size or the interaction of the two was significant at $p = 0.1$, p-values for all three are provided. Mean separations are provided for significant ($p < 0.05$) differences.

	Trap Type								Significance	
	O10	O5	F10	F5	S10	S5	SA10	SA5		
Frogs										
Heleioporus australiacus	0	0	1	2	0	0	0	0	Design ($p < 0.05$), Size ($p = 0.55$), D*S ($p = 0.78$)	$O^a F^b S^a SA^a$
Pseudophryne australis	1	1	0	0	0	0	0	0		
Pseudophryne bibronii	1	0	0	0	0	0	0	0		
Uperoleia laevigata	3	8	13	4	2	0	6	5	Design ($p < 0.05$), Size ($p = 0.60$), D*S ($p = 0.17$)	$O^a F^a S^b SA^a$
Total Frogs (FROGTOT)	5	9	14	6	2	0	6	5	Design ($p < 0.01$), Size ($p = 0.57$), D*S ($p = 0.37$)	$O^a F^a S^b SA^a$
Frog Species (FROGSPEC)	0.83	1.0	0.83	0.83	0.17	0	0.67	0.67		
	(3)	(2)	(2)	(2)	(1)	(0)	(1)	(1)	Design ($p < 0.01$), Size ($p = 0.90$), D*S ($p = 0.87$)	$O^a F^a S^b SA^a$
Lizards										
Amphibolurus diemensis	0	0	1	0	0	0	0	0		
Diplodactylus vittatus	0	1	0	0	1	0	0	0		
Pygopus lepidopus	0	0	0	0	0	0	1	0		
Carlia burnettii	2	1	0	1	1	0	1	1		
Cryptoblepharus virgatus	3	1	0	2	1	0	0	0		
Ctenotus taeniolatus	3	2	6	1	0	3	1	2		
Lampropholis delicata	0	4	2	1	0	1	0	0		
Eulamprus tenuis	1	0	0	0	0	0	0	0		
Tiliqua scincoides	1	0	0	0	0	0	0	0		
Total Lizards (LIZTOT)	10	9	9	5	3	4	3	3		
Lizard species (LIZSPEC)	1.67	1.33	1.33	0.83	0.5	0.5	0.5	0.67		
	(5)	(5)	(3)	(4)	(3)	(2)	(3)	(2)	Design ($p = 0.09$), Size ($p = 0.56$), D*S ($p = 0.73$)	—
Total animals (ALLTOT)	15	18	23	11	5	4	9	8	Design ($p < 0.01$), Size ($p = 0.48$), D*S ($p = 0.54$)	$O^a F^{ab} S^{bc} SA^c$
Animal species (ALLSPEC)	2.5	2.33	2.0	1.67	0.67	0.50	1.17	1.17		
	(8)	(7)	(5)	(6)	(5)	(2)	(4)	(3)	Design ($p < 0.001$), Size ($p = 0.66$), D*S ($p = 0.87$)	$O^a F^{ab} S^{bc} SA^c$

Table 4. Frogs and Reptiles captured by different pitfall trap designs in Bondi State Forest. No significant difference was found between trap types for any taxa. F-values and probabilities are provided where P < 0.1. Values for FROGSPEC, LIZSPEC and ALLSPEC are mean number of species with total number of species for that treatment in brackets.

	Pitfall Trap Type				
	SA5	A5	S5	F5	
Frogs					
Limnodynastes peronii	0	1	0	0	
Pseudophryne bibronii	24	33	12	31	
Ranidella signifera	0	1	0	0	
Litoria ewingii	0	0	1	0	
Litoria verreauxii	0	0	0	1	
FROGTOT	24	35	13	32	
FROGSPEC	1.0 (1)	1.2 (3)	1.0 (2)	1.2 (2)	
Lizards					
Eulamprus heatwolei	8	3	3	8	
Lampropholis guichenoti	1	3	1	1	
Nannoscincus maccoyi	0	3	0	1	
Niveoscincus coventryi	0	3	2	2	
Pseudemoia entrecasteauxii	4	7	3	6	
Pseudemoia spenceri	0	0	1	1	
LIZTOT	13	19	10	19	
LIZSPEC	1.2 (3)	2.2 (5)	1.8 (5)	2.0 (6)	
ALLTOT	37	54	23	51	F = 2.85, p = 0.07
ALLSPEC	2.2 (4)	3.4 (8)	2.8 (7)	3.2 (8)	

captured in 4 m pitfall/drift fence systems with shelter traps (Trap type S10) than the same drift fence with funnel traps (Trap type F10) (Table 2). Mean counts for LIZTOT and ALLSPEC were also lower but not significant at the 5% level of significance (both P < 0.1). Fewer *N. coventryi* were captured in sheltered traps but this was not expressed as a significant difference.

Trial 3: Pitfall trap types

Significant differences between pitfall trap designs were found for *Helieoporus australiacus*, *Uperoleia laevigata*, FROGTOT, FROGSPEC, ALLTOT and ALLSPEC (Table 3). All *H. australiacus* were caught in funnel type traps (F5, F10). For *U. leavigata*, FROGTOT and FROGSPEC shelter traps (S5, S10) were clearly inferior to all other trap designs. Trap design did not significantly influence captures for any lizard taxa. LIZSPEC showed a trend towards higher counts in open type traps (O5, O10, F5, F10) than shelter type traps (S5, S10, SA5, SA10). For ALLTOT and ALLSPEC, open traps (O5, O10) were superior to shelter-arm traps (SA5, SA10).

Trap size did not significantly affect capture rates of any taxa. While there was no significant quantitative differences between trap sizes for ALLSPEC there was a qualitative difference in that only the larger traps caught the larger lizard species, *Amphibolurus diemensis*, *Pygopus lepidopus*, *Eulamprus tenuis* and *Tiliqua scincoides*.

Trial 4: Pitfall trap types

No significant differences were found between trap types for any of the taxa examined (Table 4). For ALLSPEC, fewer species were caught in the shelter/arm traps (4 species) than in the other three types (8, 7 and 8 species for the funnel, shelter and drift-arm traps respectively), although the difference in mean species count was not significant. The difference in counts for ALLTOT was marginally significant (p = 0.07) and can be attributable to the difference between the open type traps (funnel and arm) and the straight shelter trap.

DISCUSSION

Drift fence length

The presence and length of drift fences have been shown to be significant factors in the capture efficiency of pitfall/drift fence systems in arid and semi-arid Australia (Morton *et al.* 1988; Friend *et al.* 1989) and elsewhere (Campbell and Christman 1982; Vogt and Hine 1982; Bury and Corn 1987). However, the effectiveness of such systems in heavily forested habitats in Australia has not been demonstrated. In the forests of the United States, short (*ca.* <5 m) fences provide effective sampling of herpetofaunal communities and are preferred over longer fences because of ease of installation (Vogt and Hine 1982; Bury and Raphael 1983).

In this study pitfall-drift fence systems with 40 m drift fences caught significantly more of some taxa than did those systems employing 4 m or no fences. Unfortunately a threshold fence length could not be adequately determined from these data. In other studies this threshold has been estimated at >15 m (Vogt and Hine 1982), 2.5–5.0 m (Bury and Corn 1987) and 7–10 m (Friend *et al.* 1989).

Clearly, 40 m drift fences may be well in excess of the threshold length required to adequately sample herpetofaunal communities but it remains to be determined what the optimum length would be. For some species, the 4 m and 40 m fence systems were not substantially different. However, for the nocturnally active frog *P. bibronii* and crepuscular lizard *N. maccoyi*, the 40 m fence system was significantly better than the 4 m fence system. This suggests that diurnally and nocturnally active animals may respond to the artificial barrier in different ways. Possibly the colour (blue) or physical structure of the drift fence may act as a deterrent for diurnally active species.

When installation time is considered, the value of long (40 m) drift fences is questionable. The ratio of average installation time for the three pitfall/drift fence systems used here was 3.3:1.7:1 (for 40 m, 4 m and 0 m systems respectively). Thus, three 0 m systems (i.e., six separate pitfall traps) would require less installation time than a single 40 m fence system. Using a crude numerical extrapolation, the former would provide higher counts for most taxa. However, for both *N. maccoyi* and *P. bibronii* the single 40 m fence would still be more efficient.

The longer fence was more effective for some measures of species number (FROGSPEC and ALLSPEC). However, whether additional 4 m fences or pitfall traps would compensate for this difference remains to be determined.

Large array trapping systems like those used by Campbell and Christman (1982) and Morton *et al.* (1988) or simple, long, drift fences (Friend 1984; Friend *et al.* 1989, this study) may be impractical for use in heavily forested areas as a resource inventory tool because they are limited by unsuitable terrain, abundant natural obstacles such as logs and other debris and by installation time (Bury and Raphael 1983). Bury and Corn (1987) also noted the considerable ground disturbance caused by installation of long drift fences and suggested that a settling-in period of approximately 30 days was required. In forested North America, Bury and Raphael (1983) suggested using small drift fences. However, the results of this study suggest that, in the eucalypt forests of southeastern Australia at least, groups of individual pitfall traps may be just as efficient as drift fence systems of any length. In Bondi S.F. (Webb 1991a) and the nearby Coolangubra State Forest (Webb 1985, 1991b), groups of pitfall traps have been successful in capturing all or most of the small ground-dwelling vertebrate fauna known from these areas as well as detecting the occasional rare, cryptic, large or arboreal species.

Pitfall trap size

Size of pitfall trap (within the range examined) appeared to have little effect on the number of individuals and species captured. This differs from Morton *et al.* (1988) and Friend *et al.* (1989) as they caught significantly more animals in larger rather than smaller pitfall-traps. In those studies the response of some composite taxa and individual species was less clear, but large traps were generally more efficient for most taxa.

At Glenorie, the larger lizards, *A. diemensis, P. lepidopus, E. tenuis* and *T. scincoides* were captured only in the 10 L pitfall traps. However, this bias was not expressed as a significant difference. Similarly, Morton *et al.* (1988) and Friend *et al.* (1989) found that smaller pitfall traps did not detect some of the larger species and generally caught fewer of the larger species. In an earlier study in North America, Banta (1957) found that deep pitfall traps were necessary to capture the larger lizards in his study area. Vogt and Hine (1982) also found large pitfall traps (19 L) were more effective than small (4 L) traps for snakes, lizards and frogs.

Thus, for generally small species, size of pitfall trap may not have a significant bearing on capture rate, but trap size may be important in detecting larger species.

Pitfall trap design

Shelter traps

Sheltered pitfall traps are useful in arid environments in that they act as attractants to animals seeking shelter from extreme temperatures (Banta 1957; Williams 1968; Parker 1971). However, Read (1985) has suggested that sheltered pitfall traps are of little use in capturing small mammals in arid Australia. Braithwaite (1983), working in tropical forest and woodland of northern Australia, found that sheltered pitfall traps were less efficient than pitfall traps with an overlying 4 m drift fence. However, this

difference may be attributable to channelling of animals by the drift fence rather than the design of the pitfall trap. The data presented here from trials 2 and 3 indicate that sheltered pitfall traps are generally less efficient than un-modified open-necked pitfall traps, catching fewer individuals and fewer species. Morrill (1975) has previously noted this effect for ground-dwelling insects.

Funnel traps

How *et al.* (1984) found that funnel traps were more effective than open traps in catching small mammals but not lizards. This is presumably related to the ability of small mammals to jump out of the wider aperture open traps. In this study, funnels were no more effective than open-necked pitfall traps for any taxa except *H. australiacus* (trial 3). Given that the funnel should act as a barrier to escape from the bucket a greater capture would be expected for larger species. This was not the case, suggesting that the funnel may obstruct the entrance to the bucket by allowing purchase on the sides, or by being too small in aperture to allow access.

Drift arm traps

The use of small drift arms to increase the coverage of the pitfall traps was also no more efficient than open-necked traps (funnel traps — trial 4). When combined with shelter lids, these drift arms were also less effective than open-necked traps but provided slightly improved counts over straight shelter traps for a number of taxa (trials 3 and 4).

CONCLUSIONS

The data presented here, and that of others, suggests that, for forested areas in south-eastern Australia, groups of simple, open-necked, large pitfall traps may be as, or more, efficient than some of the more complex systems examined to date. However, long drift fences may be more efficient for nocturnal animals than shorter fences or individual pitfall traps. Further experimentation on drift fence length and density and spacing of pitfall traps would be useful, particularly for nocturnal or crepuscular species.

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Ethel Mary Read Research Grants

In 1985 the Council of the Royal Zoological Society of New South Wales moved to create a small research grants fund targeting projects in Australasian zoology. A scheme based on multiple small grants was devised, the monetary principal for the fund came from a bequest to the Society from Mrs Ethel Mary Read, a long-time supporter of the Society. After much deliberation, it was decided that the target group for these grants should be students or new workers who had yet to prove their expertise in zoological research. It was felt that established researchers had other avenues for funding whereas novices in zoology were very limited in sources of financial assistance. This granting system would therefore be catering for short-term projects which may be pilot studies or research into unproven areas of study. Established researchers were not excluded from applying for funds but the small size of the grants limited their use, such as for bridging finance or to cover short-falls in larger projects. The first call for applications for the Ethel Mary Read Research Grants was announced in January 1986. This grant scheme is now well known. New grant applications are announced annually and the review committee receives applications from students and junior researchers in all parts of Australia.

In 1998, eight $600 grants were awarded. These were:

- Andrew Baird (James Cook University) — The length of the larval phase of corals.
- Belinda Cooke (University of Technology, Sydney) — Behavioural and ecophysiological studies on the Regent Honeyeater.
- Emma Cronin (University of Adelaide) — Energetics of respiration and development of the cephalopods *Sepia apama* and *Sepioteuthis australis*.
- Matthew Crowther (Sydney University) — Evolution, systematics and ecology of *Antechinus stuarti-Antechinus flavipes* complex.
- Sharon Downes (Sydney University) — Using behavioural assays to investigate the mechanics of predator-prey coevolution in reptiles.
- Natasha Lebas (University of Western Australia) — The mating system of the dragon lizard *Ctenophorus ornatus*.
- Elizabeth Tasker (Sydney University) — Effect of management-induced differences in habitat complexity on small mammal community structure.
- Dimitrios Zabaras (University of Western Sydney) — Chemical communication in insects of economic significance.

Arthur White
Council Member